



Technical Planning

Systems and Software Technology Conference

May 2, 2006

**Warren M. Anderson, Colonel, USAF
Deputy for Systems Engineering Plans and Policy
Office of the Under Secretary of Defense (AT&L), Defense
Systems, Systems Engineering, Enterprise Development**



Top Five Systems Engineering Issues*

- Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs
- Adequate, qualified resources are generally not available within government and industry for allocation on major programs
- Insufficient SE tools and environments to effectively execute SE on programs
- Requirements definition, development, and management is not applied consistently and effectively
- Poor initial program formulation



USD(AT&L) Imperative

I should note ... that we have taken important steps that will help us to produce improved capability on time and within budget by re-energizing our approach to systems engineering. This critical discipline has always contributed significantly to effective program management at every level and will receive sustained emphasis during my tenure.

Testimony of The Honorable Kenneth J. Krieg, USD(AT&L),
before US Committee on Armed Services, September 27, 2005



What We Have Done To Revitalize Systems Engineering

- Established SE Forum—senior-level focus within DoD
- Issued Department-wide systems engineering (SE) policy
- Issued guidance on SE and test and evaluation (T&E)—focused on effective, early engagement of both
- Instituted system-level assessments in support of OSD major acquisition program oversight role
- Working with Defense Acquisition University to revise SE, T&E, and enabling career fields curricula (Acq, PM, CM, FM)
- Leveraging close working relationships with industry and academia

<http://www.acq.osd.mil/ds/se/index.html>

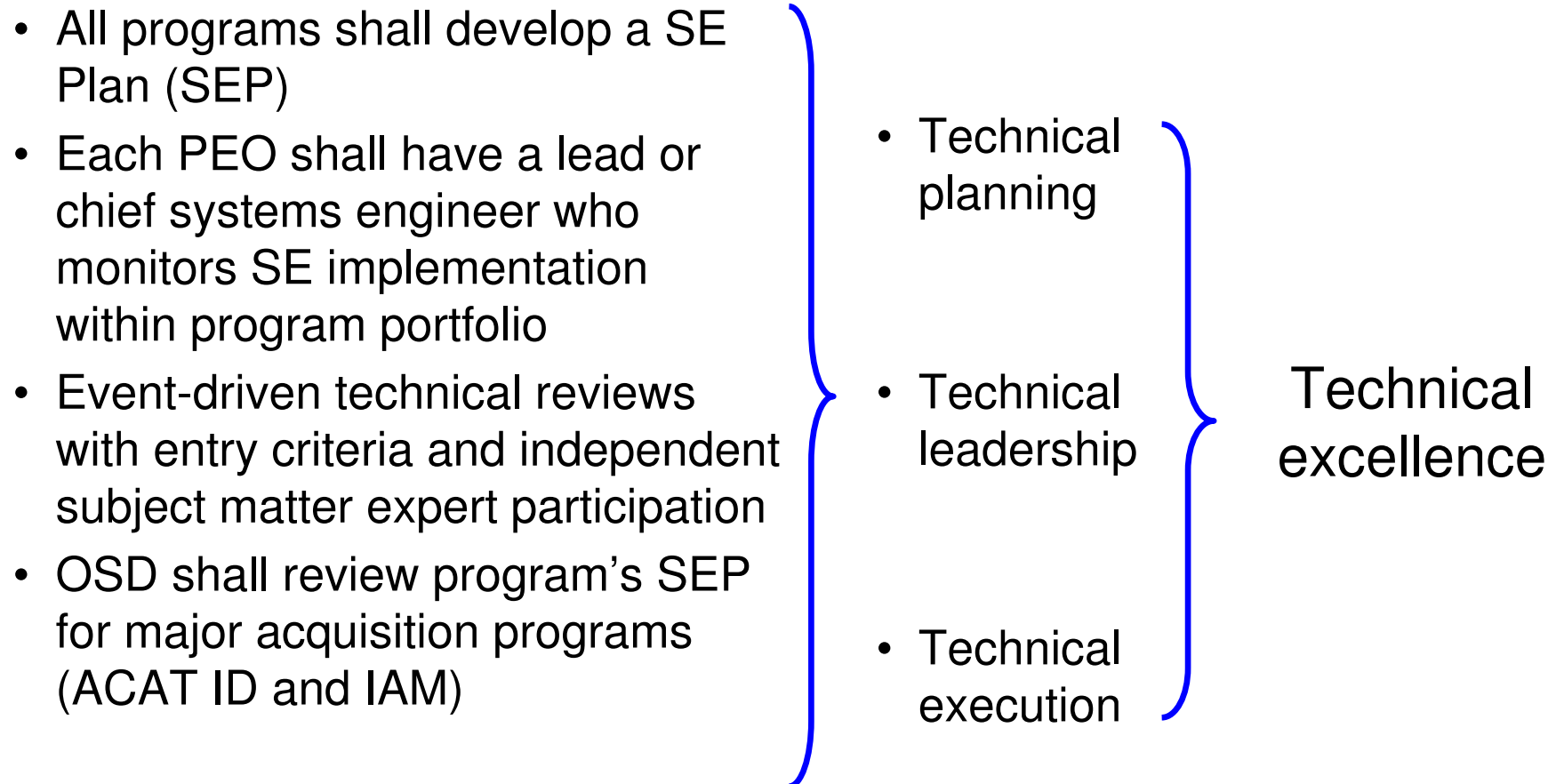


DoD Response Policy and Guidance

- Policy
 - Programs shall apply robust SE approach and develop a SE Plan
 - Each PEO shall have a lead or chief systems engineer
 - Event-driven technical reviews with entry criteria and independent SMEs unless waived by MDA
 - OSD shall review program SEPs for ACAT ID and IAM programs
 - Defense Systems shall establish a SE Forum
- Guidance
 - *Defense Acquisition Guidebook*: SE in DoD Acquisition, SE Processes, SE Implementation in the System Life Cycle, SE Tools and Techniques, and SE Resources; Test & Evaluation
 - Systems Engineering Plan: interim guidance, Preparation Guide, and five focus areas to address in technical planning throughout the system life cycle



Striving for Technical Excellence



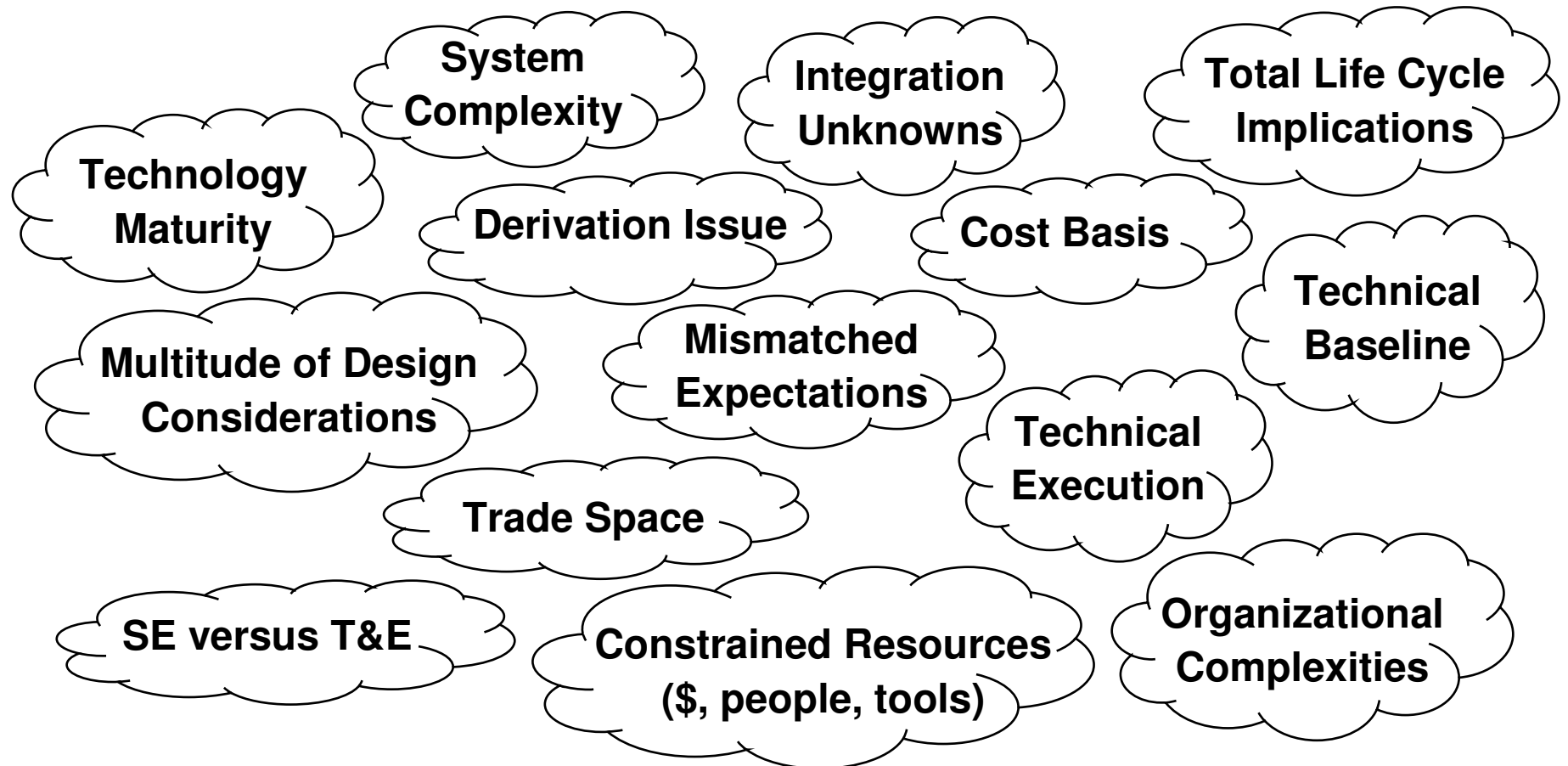
Strong technical foundation is the value of SE to the program manager



Why Plan?



Technical Planning Drivers



What does “SE” mean on your program?



Benefits of Technical Planning

- Technical planning fosters escalating understanding of the technical challenge and the insightful data for establishing executability → • An executable Acquisition Strategy
- Technical planning fosters escalating understanding of the technical challenge, providing increased confidence over time in a valid cost estimate → • A valid Cost Estimate
- SE process critical to requirements maturation from concept through test → • A valid Requirement
- Technical planning ensures verification and validation are part of the technical baseline → • A report from the Evaluator
- Technical planning integrates sustaining engineering as a readiness enabler → • A plan for Sustainment

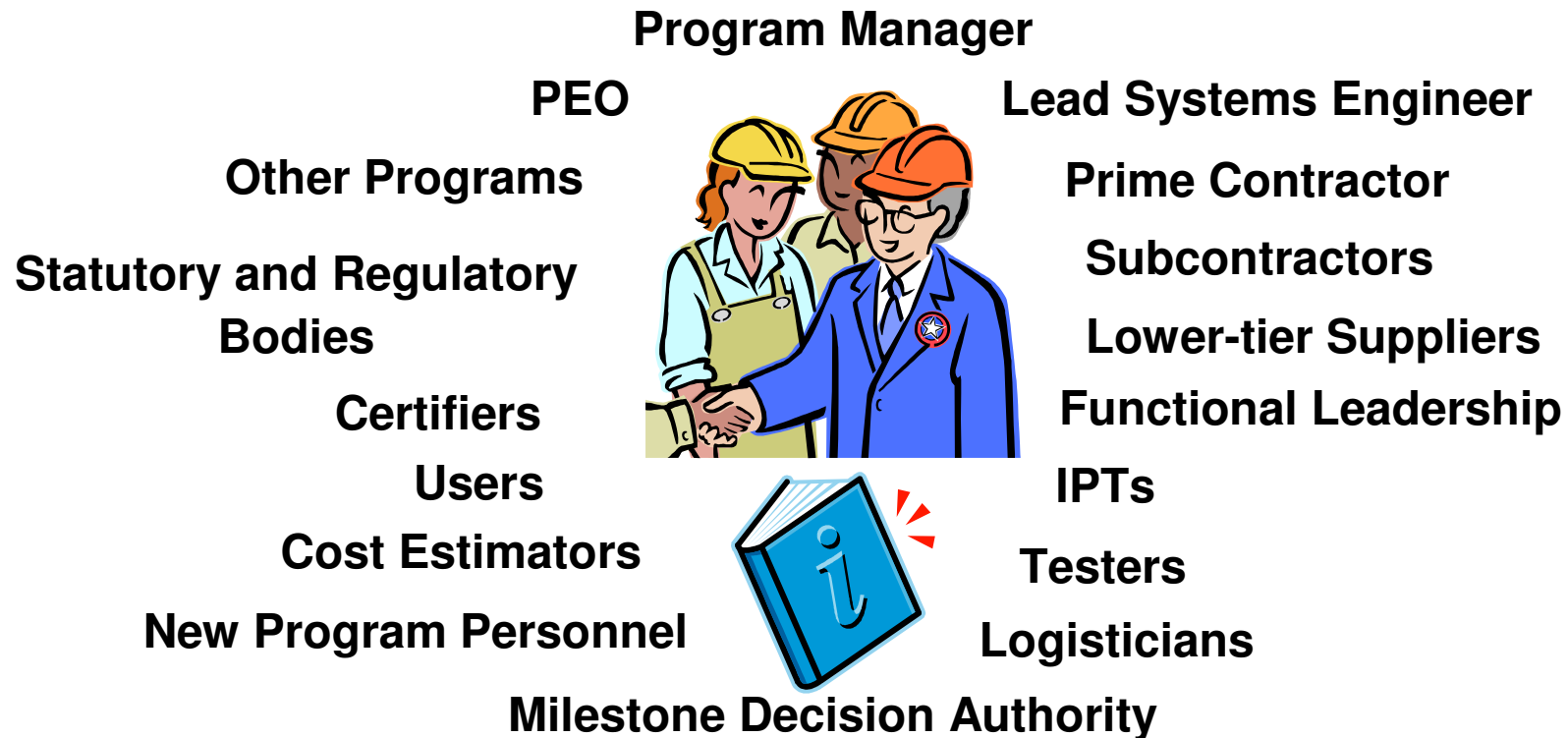
What Decision Makers Need To Make An Informed Decision



Why Document the Plan?



SEP Stakeholders



A SEP Provides a Means for Collective Understanding Among All Stakeholders as to Program's Technical Approach



Driving Technical Rigor Back into Programs “Importance / Criticality of Technical Planning”

- Program’s SEP provides insight into every aspect of a program’s technical planning, focusing on:
 - What are all the program requirements?
 - Who has responsibility and authority for managing technical issues—what is the staffing and organization to support the effort?
 - How will the technical baseline be managed and controlled?
 - What is the technical review process?
 - How is that technical effort linked to overall management of program?
- Living document with use, application, and updates clearly evident

The SEP is fundamental to technical and programmatic execution on a program



SEP Observations

- Descriptions vice plans
 - Regurgitated theory
 - Generic text, applicable to _____
 - Disconnected discussion
 - No numbers or specifics
 - No names
 - No timeframes or ordered relationships
 - Not reflective of known industry best practice
 - Technical baselines
 - Technical reviews
 - Entry criteria for technical reviews
 - Peer participation
- What
 - How
 - Why
 - Where
 - Who
 - When



Driving Technical Rigor Back Into Programs

“Emerging SEP Comments (First Drafts)”

(not systemic across all programs)

- Incomplete discussion of program requirements
 - Missing categories such as statutory, regulatory, or certifications
- Minimal discussion of program IPTs
 - Need to identify technical authority, lead systems engineer, and key stakeholders
 - Addresses part of SE organization, such as prime; no mention of government, subcontractors, or suppliers
- Incomplete technical baseline
 - How does the program go from CDD to product—traceability?
 - Linkage to EVM—not able to measure technical maturity via baselines
- Incomplete discussion of technical reviews
 - How many, for what (should tie to baselines and systems/subsystems/configuration items), and by whom (should tie to staffing)?
 - Lacking specific entry criteria
 - Peer reviews
- Integration with other management planning
 - Linkage with acquisition strategy, IMP, IMS, logistics, testing, and risk management
 - Schedule adequacy—success-oriented vice event-driven; schedule realism
 - Contracting for SE

**75 SEPs
reviewed
from 46
programs**

Compelling Need to Engage with Programs Early in Process

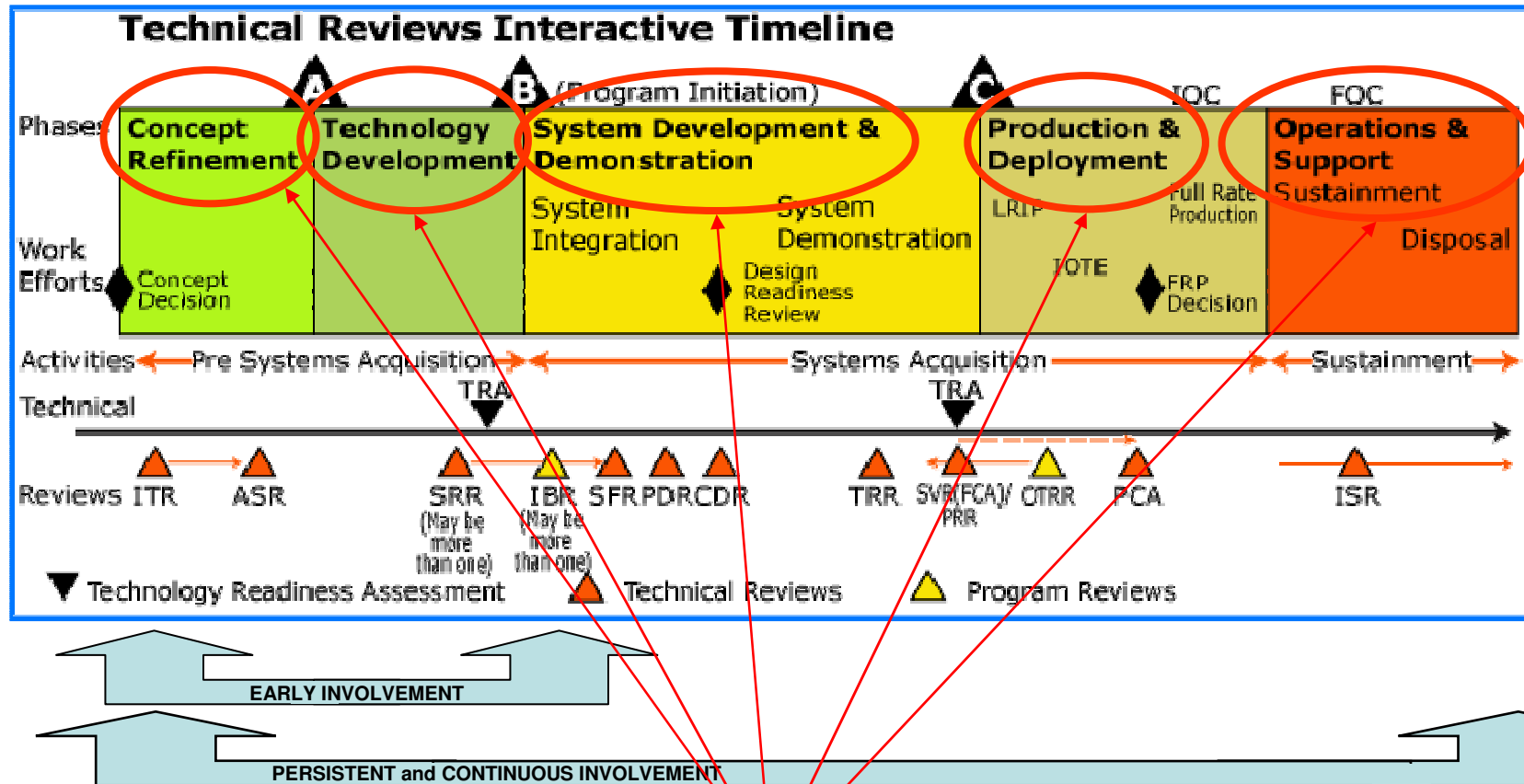


**When Should Technical
Planning Occur?**

Who Should do It?



Scope of Technical Planning



Sound technical planning is needed in EVERY acquisition phase



Technical Planning Timeline

Milestone



- RFP Preparation
 - Acquirer's Technical Approach as Documented in Draft SEP
 - Written by Program Manager, Lead SE, Lead Tester, and Lead Logistician



- Source Selection
 - Offeror's Proposed Technical Approach based on Draft SEP
 - Evaluated by Source Selection Evaluation Board



- Post-Award Planning
 - Program Team's Technical Approach as Documented in Program SEP
 - Written by Program Manager, Lead SE, Lead Tester, and Lead Logistician from Government, Prime, Subs, and Suppliers



- Execution
 - Execute the Technical Approach
 - Updated by Program Team

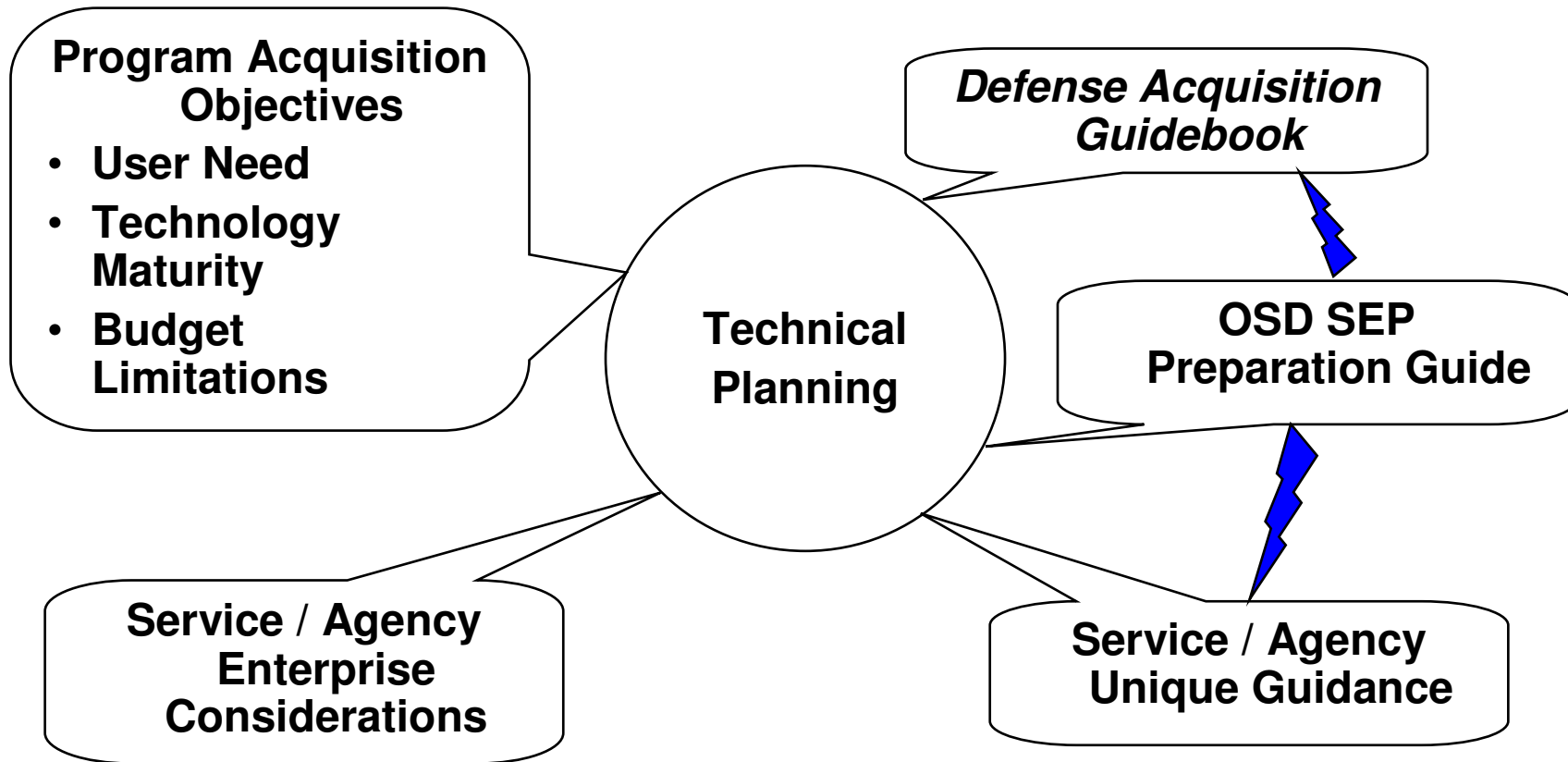
A shared "vision" of SE on your program



**What should be addressed
in a sound technical plan
for a program?**



Technical Planning Considerations



This is the Program Manager's Planning!



Guidance and Tools

- *Defense Acquisition Guidebook:*

- SE in DoD Acquisition
- SE Processes
- SE Implementation in the System Life Cycle
- SE Tools and Techniques, and SE Resources
- Life Cycle Logistics in SE
- Test & Evaluation

Chapter 4

Chapter 5

Chapter 9

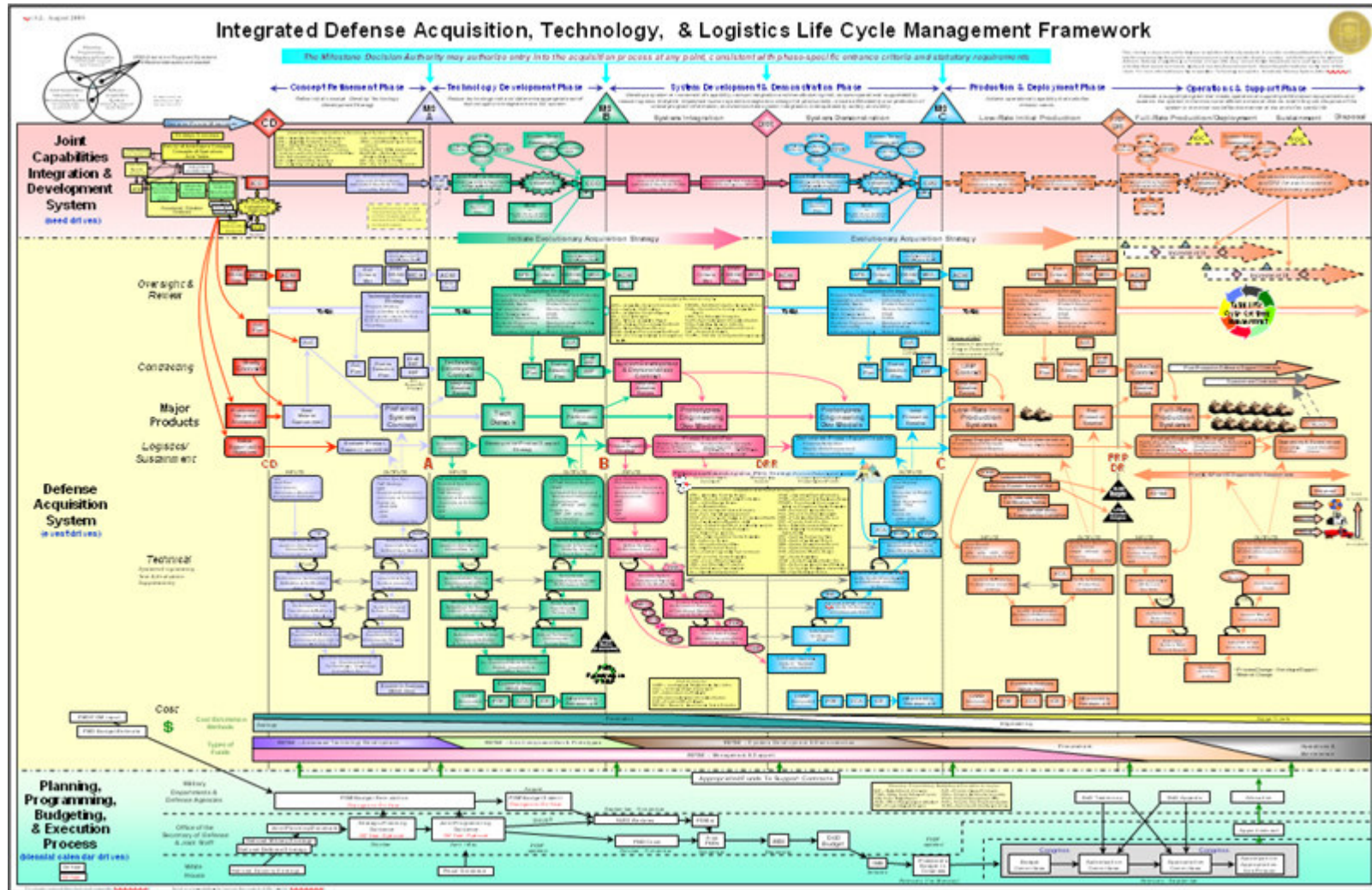
- SEP:

- Interim guidance
- Preparation Guide
- Twenty-five focus areas to address in technical planning



SE in the System Life Cycle

“The Wall Chart”



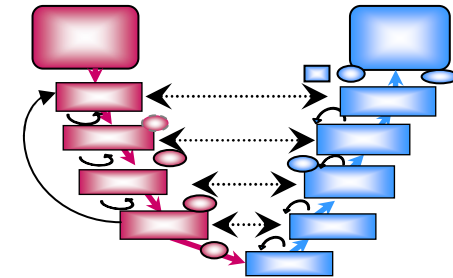


SE in the System Life Cycle

Defense Acquisition Guidebook

Chapter 4, Section 4.3

- By phase consideration of SE activities
 - Purpose of SE in the phase
 - Inputs to the SE process
 - Key SE activities during the phase
 - Technical reviews during the phase
 - Outputs of the phase's SE process
- Full life cycle coverage from Concept Refinement through Operations and Support





Guidance and Tools

- *Defense Acquisition Guidebook:*

- SE in DoD Acquisition
- SE Processes
- SE Implementation in the System Life Cycle
- SE Tools and Techniques, and SE Resources
- Life Cycle Logistics in SE
- Test & Evaluation

Chapter 4

Chapter 5

Chapter 9

- **SEP:**

- Interim guidance
- Preparation Guide
- Twenty-five focus areas to address in technical planning



Driving Technical Rigor Back Into Programs

SEP Focus Areas for Technical Planning in SDD/Production and Deployment

- Program Requirements
 - Capabilities, CONOPS, KPPs
 - Statutory/regulatory
 - Specified/derived performance
 - Certifications
 - Design considerations
- Technical Staffing/Organization
 - Technical authority
 - Lead Systems Engineer
 - IPT coordination
 - IPT organization
 - Organizational depth
- Technical Baseline Management
 - Who is responsible
 - Definition of baselines
 - Requirements traceability
 - Specification tree and WBS link
 - Technical maturity and risk
- Technical Review Planning
 - Event-driven reviews
 - Management of reviews
 - Technical authority chair
 - Key stakeholder participation
 - Peer participation
- Integration with Overall Management of the Program
 - Linkage with other program plans
 - Program manager's role in technical reviews
 - Risk management integration
 - Test and logistics integration
 - Contracting considerations

Adapt for Domain and Enterprise Considerations



**How would technical planning
need to change to
accommodate programs Pre-
Milestone B and Post-
Milestone C?**



Driving Technical Rigor Back Into Programs

SEP Focus Areas for Technical Planning in Concept Refinement / Technology Development

- Program Requirements
 - **Desired capabilities; required attributes**
 - **Potential statutory/regulatory, specified/derived performance, certifications, design considerations**
 - **Enabling technologies**
 - **Cost/schedule constraints**
 - **Future planning**
- Technical Staffing/Organization
 - Technical authority
 - Lead Systems Engineer
 - **SE role in TD IPT**
 - IPT organization and coordination
 - Organizational depth
- Technical Baseline Management
 - Who is responsible
 - Definition of baselines
 - **ICD/CDD traceability**
 - Technical maturity and risk
- Technical Review Planning
 - Event-driven reviews
 - Management of reviews
 - Technical authority chair
 - Key stakeholder participation
 - Peer participation
- Integration with Overall Management of the Program
 - Linkage with other program plans
 - Program manager's role in reviews
 - Risk management integration
 - Test and support strategy
 - Contracting considerations

Adapt for Domain and Enterprise Considerations



Driving Technical Rigor Back Into Programs

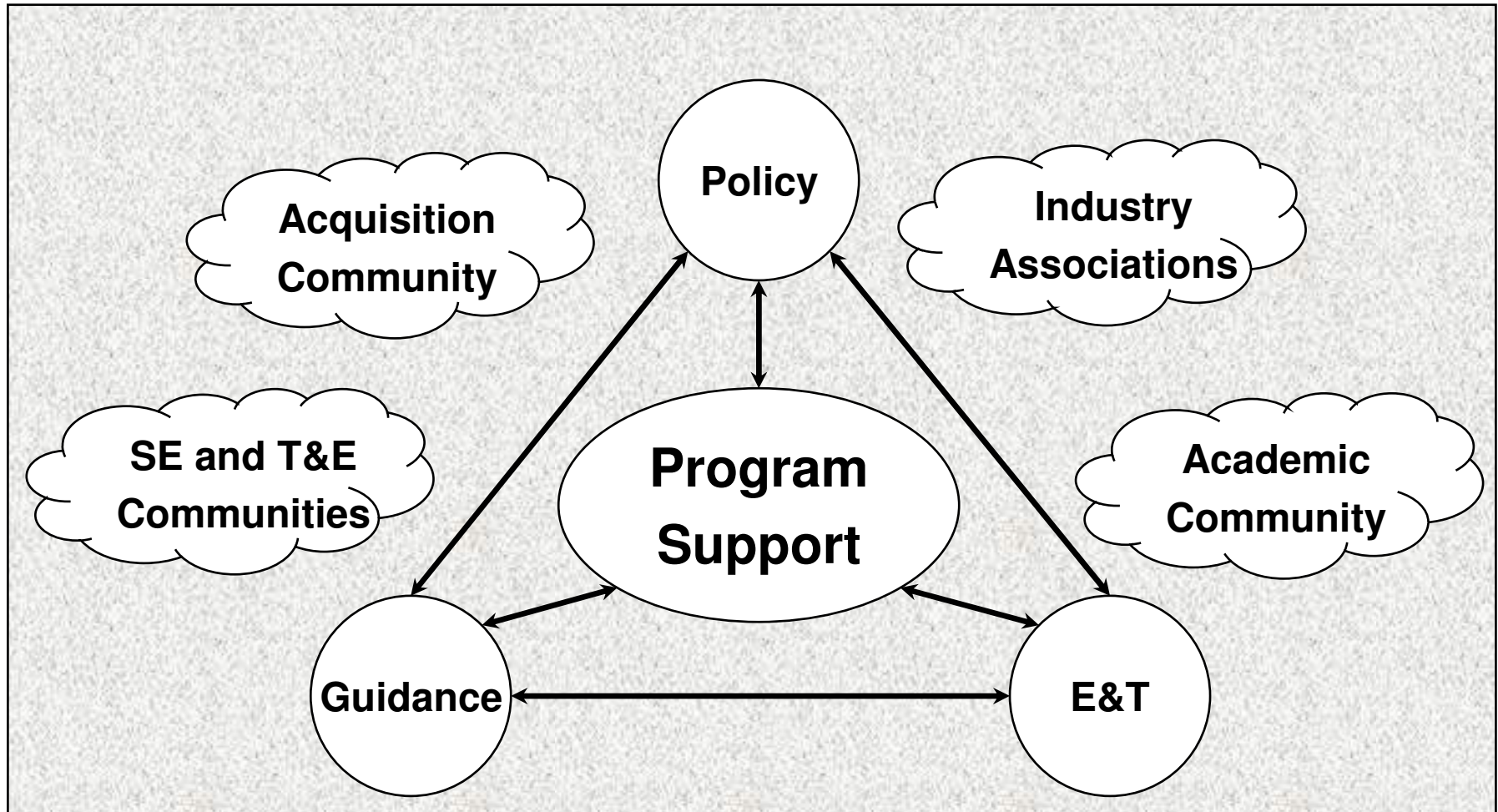
SEP Focus Areas for Technical Planning in Sustainment

- Program Requirements
 - **Technical surveillance approach**
 - **Tracking of actual vs. planned usage**
 - **Monitoring of system hazards, risks, certifications**
 - **Tracking of usage, corrosion-related maintenance and repair costs, and total ownership costs**
 - **Management of configuration changes and incremental modifications**
- Technical Staffing/Organization
 - Technical authority
 - Lead Systems Engineer
 - **Coordination of sustaining engineering with operational, maintenance, and repair domains**
 - **Sustaining support organization**
 - Organizational depth
- Technical Baseline Management
 - Who is responsible
 - Definition of baseline management
 - **Requirements and certification traceability and verification of changes**
 - Specification tree and WBS link
 - **Tracking of operational hazard risk against baseline**
- Technical Review Planning
 - **In-service reviews**
 - Management of reviews
 - Technical authority chair
 - Key stakeholder participation
 - Peer participation
- Integration with Program Management
 - **Linkage with overall sustainment**
 - **Program manager's role in in-service reviews**
 - Risk management integration
 - Logistics integration
 - Contracting considerations

Adapt for Domain and Enterprise Considerations



Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!



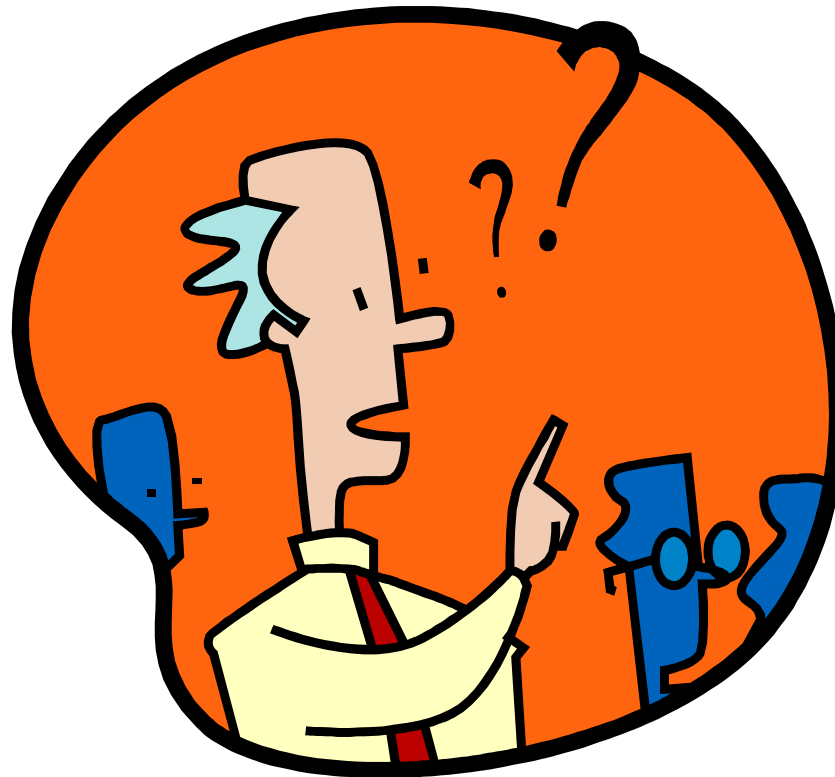
Summary

- OSD's fundamental role is to set policy, provide relevant and effective education and training, and foster communication throughout the community—much has been accomplished
- OSD cannot do everything...nor should we
- Challenges Remain
 - Getting ALL programs properly structured through effective planning—SEP/TEMP/Risk Management Plan/Exit Criteria/ASR
 - Refocusing Acquirer and Supplier on technical management of programs
 - Ensuring adequate Government technical resources

Services and Agencies, along with Industry, must take ownership of the institutionalization of SE



Questions...perhaps Answers





**What should be addressed
in a sound technical plan
for a program?
(Continued)**



Technical Planning Area 1

- Program Requirements
 - Capabilities, CONOPS, KPPs
 - Statutory/regulatory
 - Specified/derived performance
 - Certifications
 - Design considerations



Capabilities, CONOPS, KPPs

- Most programs have KPPs, then what?
- What is the plan for how they will be managed?, Tested-to, traded against other requirements?
- How are they captured, analyzed, decomposed, and allocated?
- Who is responsible for the above?
- Who are the stakeholders?



Statutory/Regulatory

- What are all of the statutory and regulatory requirements?
- What is the plan for capturing and managing this set of requirements?
- Beyond the statutes and regulations themselves, how are the specific requirements identified, analyzed, decomposed, and allocated?
- How are these requirements to be managed in an integrated framework with KPPs, etc.
- Who is responsible for the above?
- Who are the stakeholders?



Specified/Derived Performance

- What is the plan for managing and integrating the totality of specified performance (per the applicable system spec or performance spec)?
- Who is responsible for derivation, decomposition, and allocation of requirements?
- What tools will be used and what organizational elements are responsible for ensuring requirements traceability?
- How will the program ensure that these requirements are managed across contractual boundaries (subsystem suppliers)?



Certifications

- What are all of the certifications to which the program is subject? How does the program ensure that all applicable certification are identified?
- Who are the stakeholder organizations responsible for certification requirements?
- How will the program ensure that all of the certification requirements find their way into the integrated set of requirements?
- How are the respective certification processes integrated with the program's own design, development, and test approach?



Design Considerations

- What is the program's approach to addressing and managing the ever-growing list of potentially applicable design considerations?
- How are these requirements integrated with the other requirements (both specified and derived)?
- Who is responsible for addressing these requirements that span a broad range of domains and subject matter areas?
- How will technical budgets be established, allocated, and managed (reliability, weight, etc.)?



Technical Planning Area 2

- Technical Staffing/Organization
 - Technical authority
 - Lead Systems Engineer
 - IPT organization
 - IPT coordination
 - Organizational depth



Technical Authority

- What technical authority (functional leads) is implied from the integrated set of Requirements (KPPs, statutory, regulatory, specified, certification, design considerations)?
- What organizations will be supporting the program in the role of technical authority?
- How will the program leverage tech authority resources and balance the need to support with the budgetary constraints?
- What is the program's approach to integrating technical authority on the appropriate IPTs?



Lead Systems Engineer

- Does the program have a lead systems engineer? Who is this person and how do they interact with SE technical authority?
- What is the LSE's role and authority on the program relative to SE processes and products (technical reviews, technical baselines, etc)?
- How will the LSE and the PM coordinate in technical management?
- What is the plan for how the LSE will manage SE activities vertically and horizontally across IPTs?



IPT Organization

- What is the program's approach to the IPT structure?
- How does the IPT structure relate to the program's products?
- What is the program's plan for alignment of the WBS with the IPT structure?
- How are the IPTs populated to integrate all stakeholders (users, developers, testers, technical authority, and design considerations)



IPT Coordination

- How are the systems engineering processes managed and controlled across the IPTs?
- How are the systems engineering products (requirements and technical baselines) managed and controlled across the IPTs?
- If there are functional as well as product IPTs, what is the program's approach to the respective roles?
- How does the program's IPT structure and operation provide for system integration?



Organizational Depth

- Does the SEP address overall organization of Government and contractor systems engineering tasks, activities, and responsibilities (requirements, technical baseline, technical reviews, etc) from prime contractor down to lowest level supplier?
- If a part of system-of-systems or family-of-systems, what is the interaction with higher and peer organizations and authorities regarding design trades?



Technical Planning Area 3

- Technical Baseline Management
 - Who is responsible
 - Definition of baselines
 - Requirements traceability
 - Specification tree and WBS link
 - Technical maturity



Who is Responsible?

- What is the program's approach to overall management of the technical baselines? Who are the participants across the program?
- How does this approach relate to the roles and responsibilities of the lead systems engineer, the IPT leads, and any functional IPTs assigned for requirements management?
- What is the plan for technical baseline management across IPTs and across the program office, prime, and sub-suppliers?



Definition of Baselines

- What is the program's approach to utilization of technical baselines as a technical management tool?
- How are technical baselines used to across the domains of functional, allocated, and product attributes?
- What is the program's approach to these baselines relative to the WBS? EVM? TPMs?
- How is the program using technical reviews to manage the technical baselines and assess technical maturity and risk?



Requirements Traceability

- How are requirements (KPP, statutory, regulatory, specified, derived, certification, design considerations, etc) tracked from source to (and throughout) the program technical baseline and specification tree?
 - What is the program's plan to ensure that there are no "orphan" or "childless" requirements?
 - What tools will be used and by whom?
- Is this traceability addressed in the requirements management and configuration management planning?
- Does the traceability extend to the verification and validation requirements and planning?



Specification Tree and WBS Link

- What is the program's WBS and how does it relate to the end item configuration?
 - Is the plan reflective of an understanding as to how many CIs are planned?
 - What is the program's approach to technical baseline specifications (system spec(s), functional spec(s), subsystem specs(s), design spec(s) and is there alignment between the WBS and the planned technical baselines (specs)?
- What is the program's approach to managing against the WBS across contractual boundaries?
- How does the program plan to use the WBS and the specifications as a technical management tool across the SE tasks?
- What is the program's approach down to the CI level?



Technical Maturity

- What is the program's plan to measure technical maturity (as opposed to TPM tracking)?
- How is the program using the SE products of the technical baseline (functional, allocated, and product) to gauge technical maturity?
- Who is involved in this assessment from a stakeholder perspective?
- Has the program established maturity criteria and what is the plan for application of these criteria across the WBS and down to the CI level?



Technical Planning Area 4

- Technical Review Planning
 - Event-driven reviews
 - Management of reviews
 - Technical authority chair
 - Key stakeholder participation
 - Peer participation



Event-driven Reviews

- What is the program's approach to executing event-driven reviews?
 - Are best practice criteria being applied?
 - Is technical authority being engaged to develop criteria for specific reviews and who will assess readiness for the conduct of the review?
 - How many?
 - For what?
- Is the timing of the reviews in program plan reflective of the achievable technical maturity required (per best practice) for the review?
- What is the program's plan for ensuring that reviews are event vice schedule driven?



Management of Reviews

- What is the program's approach for oversight and conduct of all technical reviews?
- Who is responsible?
- How is technical authority involved / engaged?
- How is the program planning to ensure that technical products subject to the review are available prior and to the appropriate stakeholders?
- What is the plan for integrating the outcomes of the technical reviews into the program's plan forward?



Technical Authority Chair

- What is the program's approach to chairing of technical reviews?
- How will the program ensure that reviews are conducted to "best practice"?
- How is technical authority to be engaged and what is the approach for system-level and subsystem-level reviews?
- How will the program manager, lead systems engineer, and technical authority collaborate?



Key Stakeholder Participation

- What is the program's approach to attendance at reviews?
- What is the plan to ensure that stakeholders are involved at key decision points? Example: airworthiness certifiers at technical reviews)
- Are Users, Testers, and Logisticians involved in the execution of systems engineering?
- Are representative offices from "design considerations" areas involved?
- How is the program office reconciling resource realities with these technical needs?



Peer Participation

- What is the program's approach to addressing "peer" of third party insight to the program?
- Who are these peers and from where will they be attained?
- Are there provisions for cross-talk at the peer level at key points such as the technical reviews?
- What is the program's approach to the areas (subject matter areas) that peer insight is most critical?
- Peer participation at the SE leadership level? Beyond?



Technical Planning Area 5

- Integration with Overall Management of the Program
 - Linkage with other program plans
 - Program manager's role in technical reviews
 - Risk management integration
 - Test and logistics integration
 - Contracting considerations



Linkage with Other Program Plans

- What is the program's approach to linking and integrating SE (technical management) with other management efforts?
- Was the SEP the basis for the IMP/IMS?
- Was the IMS the basis for the IBR/cost account/EVM approach?
- Were the technical baselines (across the WBS) incorporated as products in EVM?
- Are the technical review risk assessments treated as inputs to the risk management approach?
- Is the independent cost estimate based on systems engineering?
- Does the PM's program management plan use SE as the technical management arm?



Program Manager's Role in Reviews

- Is the SEP indicative of the PM using the technical reviews as a technical product to him/her?
- Is the PM (acquirer and supplier) to be an active participant on the technical review board?
- Is the program manager planning to self-chair technical reviews?



Risk Management Integration

- How are risk and systems engineering linked in the program planning?
- Does the SEP reflect strong linkages between the technical reviews and the program's risk assessment process (i.e. risks of successful completion of the next technical review)?
- Does the plan reflect the decision-making process necessary to mitigate risks?
- Does the risk management plan refer to the SEP at an operational planning level?



Test and Logistics Integration

- What is the program's approach to integration of the T&E communities in the SE process?
- Are the verification and validation plans part of the technical baselines?
- Is supportability and the support systems part of the technical baseline?
- Are the testers and logisticians involved in the technical reviews?
- Does the TEMP and ILSP align with the SEP?



Contracting Considerations

- Are there provisions in the contract to incentivize best systems engineering practices as applied on the program?
- Are technical reviews used as a basis for progress payments? (BAD)
- Are there provisions in the prime and sub-supplier contracts for the execution of technical management across contractual boundaries (SE processes and products extend across the team)?
- Is systems engineering treated in the contract as an integral part of the development or as an overhead function with no product?
- Has the supplier's systems engineering approach been "piecemealed" or "edited" to remove seemingly non-value-added work?